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OPTIMIZING TEMPERATURE AND ILLUMINATION FOR ENHANCED ASTAXANTHIN PRODUCTION BY STRAINS OF P. RHODOZYMA

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Abstract. Astaxanthin (AST) is an industrially valuable carotenoid renowned for its exceptional antioxidant activity as well as effective pigmentation [1]. It has long been of value in the food and feed industries as a colorant, with a recent upsurge of usage and demand in the pharmaceutical, nutraceutical and cosmetic as accumulating evidence bestow on it an array of biological activities including anti-diabetic, cardioprotective, anti-inflammatory as well as immune modulation [2]. Though widely distributed in nature (found in algae, bacteria, yeast, marine organisms and plants), the chemically synthesized variant predominates on the global market due to higher cost and relatively lower productivity associated with natural production [3]. It is in this regard we evaluate temperature and light in an attempt of optimize these factors for higher production of astaxanthin by the red yeast P. rhodozyma strain Y1654 and Y1655.

Shake flasks batch cultures of the two strains were cultivated for 120 hr in YPD media by inoculation with 48 hr old seed culture grown at 20 ℃ under constant illumination and agitation (150 rpm). Cultures were incubated at different temperatures (14–22 ℃) and illumination. For the effect of light, LED bulbs of different colors (Red, Blue, Green, Yellow and White) were used. Dry cell weight and astaxanthin production were assessed every 24 hr.

Though 22 ℃ as well as different colors of light are yet to be evaluated, hitherto the highest astaxanthin content was observed on the last day (after 120 hrs) for all cultures. In addition, cultures cultivated at 14 ℃ resulted in the maximum production of astaxanthin by both strains – as high as 1.81 mg/L for Y-1654 and 1.43 mg/L for Y-1655. Furthermore, Y-1654 (0.32 mg AST per 1 g DCW) is superior to Y-1655 (0.22 mg AST per 1 g DCM) in production of astaxanthin. In relation to biomass, Y-1654 (average DCW: 2.79 g/L at 20 ℃; 5.22 g/L at 18 ℃; 6.66 g/L at 16 ℃ and 5.69 at 14 ℃) generally lags behind Y-1655 (5.15 g/L at 20 ℃; 6.73 g/L at 18 ℃; 6.40 g/L at ℃) though at 16 ℃ similar DCW was observed; 6.66 g/L vs. 6.67 g/L respectively, which represents the highest biomass yield for each strain.

Temperature and illumination are crucial factors for optimizing biotechnological production of astaxanthin by P. rhodozyma. Temperatures lower that 20 ℃ are favorable for maximum production of astaxanthin by both strains of P. rhodozyma.

References

1. Effect of different sugar sources on *P. Rhodozyma* y1654 growth and astaxanthin production / O. N. Kanwugu, S. A. Shatunova, T. V. Glukhareva [et al.] // Agronomy Research. –2020. –Vol. 18, Special Iss. 4. – P. 1700–1716.
2. Biotechnological production of astaxanthin with Phaffia rhodozyma/Xanthophyllomyces dendrorhous / I. Schmidt, H. Schewe, S. Gassel, // Applied Microbiology and Biotechnology. –2011. – Vol. 89, Iss. 3. – P. 555–571.
3. Astaxanthin: A review of its chemistry and applications / I. Higuera-Ciapara, L. Felix-Valenzuela, F. M. Goycoolea // Critical reviews in food science and nutrition. –2006. –Vol. 46, Iss. 2. – P. 185–196.

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